AMERICAN

RAILROAD JOURNAL,

AND

MECHANICS' MAGAZINE.

No. 10, Vol. VII. New Series.] NOVEMBER 15, 1841. [Whole No. 394. Vol. XIII.

MANAGEMENT AND DIRECTION OF RAILROADS.

While every attention and care has been bestowed upon the construction and improvement of railroads and their machinery, but little has been done towards improving and perfecting the system of management of these works, after their completion. That this neglect is unwise in the extreme, is very evident, for the best constructed and most substantial work can be so managed as to become, in a few years, a mere ruin, and as unprofitable to its owners as if it had never possessed any advantages. That this error has been in a great degree a cause of the unsuccessful operation of many works for which a far different fate had been reasonably anticipated, cannot be denied.

The management of a completed work resolves itself into two departments,—the engineering and financial. The former of these is the most important, as upon it alone, will depend the prosperous condition of the work;—the latter should be managed simply with a view to the proper collection and disbursement of the moneys received.

Our object at present is to make a few remarks upon that portion of the management of public works which belong more properly to the engineering department, and we are the more anxious to do so, as this is a point which, in our opinion, has been sadly overlooked by the direction of railroad companies. No one would think of committing the equipment and sailing of a ship to the supercargo, although the captain is frequently entrusted with the sale and purchase of cargoes, and the reason of this is obvious, for while the

science of navigation requires the experience of years, the mercantile knowledge necessary in the purchase and sale of goods, under general directions from owners, is very simple and easily acquired. But in the management of railroads, a very different system prevails,—the supercargo sails the ship, attends to the repairs, and has unlimited control over things of which he has no knowledge, and is not likely to acquire any, unless at the expense of the owners,—or in other words, the management and repair of the road and machinery, are too often placed in the hands of those as ignorant of engineering as a supercargo is of seamanship. It cannot be expected that when a rather complicated system of machinery has been put in operation at great cost, not only of money but of the labor of professional men, that the whole can at once be handed over to persons of entirely different habits and attainments, for their exclusive control, unless at great hazard.

Although many companies have undoubtedly been so fortunate as to secure the services of non-professional persons, highly capable of carrying on the mechanical department, it is yet to be considered whether the influence of a respectable engineer is not calculated to operate to better advantage for the interest of the company, than the mere opinion of an individual generally under the control of one or two directors. We need no better evidence upon this head than the comparative success of those roads which are under the superintendance of engineers, and those upon which no such arrangement prevails.

The great objection to the employment of resident engineers as general superintendants of railroads, is the expense. Retrenchment and reform are the great words of the day; but that they always mean what they profess to mean, we are by no means willing to admit. It is considered a great master stroke in financiering, particularly on the coming in of a new board, to show how much of the current expense of the road has been, or rather is intended to be, cut off. Great eclat attends this curtailment, while but few think of looking into the accounts to see whether what has so suddenly been taken off at one end, has not been as suddenly put on at the other. There are few items of expense more insidious than wear and tear of machinery, and it is quite possible that with the same amount of receipts, a reasonable profit may remain in one case, or be eaten up in another. Moreover, the condition of a railroad track has an important influence upon the machinery, and a false economy upon the one, may be imperceptibly bringing ruin upon the other—the yearly expenses are shown to be small, and stockholders are an-

nually gratified by a fair detail of monies saved, and by good dividends—but in a short time the whole road and every thing belonging to it are racked to pieces.

Proprietors should recollect that it is the interest of those in power to retain their influence, and they themselves are too apt to look at the present value of the stock—but while this is well enough for dealers in stocks, it is proper that those who look for permanent investments should keep an eye to the preservation of suitable checks upon a speculative spirit. The tendency of the times is so much towards the abuse of power in the hands of corporations or rather of a few individuals in these bodies, that great care should be taken to avoid even the appearance of evil, and no better means can be taken to advance the character of railroads as an investment, (and good roads are already favorites,) than by establishing a check upon the financial direction, which may prove to stockholders that all is fair and above board, and that the condition of their property is not yearly depreciated to swell the amount of their *apparent* profits. To prevent this, proprietors of railway stock in particular, should not be so direlict of their true interests, as not to follow the example of England, in having annual *competent* investigations into their condition and management.

But it is by no means necessary, that the intention to deceive should exist, to produce the same results. Self deception may prove as fatal as downright fraud, why then trust to those who are most likely to be misled because they are not even supposed to possess the proper information? It is but a poor comfort when money has been lost to say, that it has happened rather from the ignorance than the dishonesty of those to whom it has been entrusted.

But the expense of employing engineers in such situations has been greatly overrated. When railroads were first introduced, the demand for civil engineers was far greater than the supply, but at present, very many competent and experienced men can be found who would be the means of saving more than the most liberal salary would cost. Moreover, the expense of superintendance alone would hardly be increased by such an arrangement, for the substitution of one responsible and intelligent head for several offices, would in itself, in some cases, at least be the means of saving expense.

This subject is one upon which much more might be said, and to which we hope again to return. The character which the profession will attain when properly united and organized, will have great influence upon the whole railroad system, and to such an organization do we look with the earnest hope that among many other

important topics, the present will receive their attention, and much assistance to the cause be derived from the information thus accumulated.

[For the American Railroad Journal and Mechanics' Magazine.]

COLLATERAL ADVANTAGES OF RAILWAYS.

The "Sketch of a Railway," etc., on this important subject furnishes the following note, No. 31 :—

"It is not to be expected that the collateral advantages of improvements of any sort are to have much influence in promoting their contruction, the majority only recognizing that which touches them *directly*. But they are of no small importance, and should be better understood than they generally are. It is among our eastern friends that they are most fully appreciated, and their testimony on such points, as close calculators is always valuable. Thus they say :—

"'That it cannot be doubted that a railway, by economy of time saves three-quarters of the labor and expense of transporting burdens and persons. At a low estimate for Massachusetts this expense is calculated at 16,000,000 of dollars, of which 12,000,000 per annum could be saved. Every month's delay is, therefore, a shameful waste of 1,000,000 of dollars.'"

So reasoned these far seeing people, who have now the practical demonstration, that such is the effect of the railway ; but it is not elsewhere so generally recognized, even among the more intelligent. If indeed it were practicable to withdraw the railway, its advantages would then be brought immediately home to the people, and who would quickly find their condition without it, to resemble most nearly that of "fish out of water."

A case of this kind occurred not long since on the coast of Chili. The steamboats which had been established along that coast, through and under the agency of our enterprising countryman, Mr. Wheelright, and which had made neighbors of those, between whom scarcely any intercourse had ever existed, were suddenly suspended by the exhaustion of their stock of fuel, for which they had relied on supplies in coal from England. The effect was, as if the world had ceased its revolutions, and the impatience along the whole coast under this suspension is easier imagined than described. Such a calamity it is now said will be averted for the future, by the discovery of mines of a suitable quality of coal on that coast.

Projects of public improvements, however, by private enterprise,

having their origin mainly if not entirely in the great spring of selfish views, it is not reasonable to expect for them any sympathy from the public, where it results, as it too often does, that the projectors have lost their money and misspent their time; but an enlightened selfishness should incline the public to deal more kindly with all such efforts, by which *they* rarely escape being benefitted, however, otherwise abortive; and this will be so, as light can be made to reach into the darker corners of the community.

But where the relative advantages of an improvement to the projectors and the public will shortly show themselves in the strongest relief, is in the case of the Philadelphia and Pottsville railway; and it is also a fitting opportunity to remark that this railway has been the least understood or appreciated in its day, considering that by casting off the dependence solely on canals for a supply of fuel, it at once relieves the communty of an onerous tax of some millions of dollars annually, from which it could *never otherwise* have escaped, and which must have swelled yearly in amount. The account may be thus made up:—

Its projectors,

On a cost of $5,000,000 for 100 miles of road, from the mines to tide water on the Delaware river at Philadelphia, after paying interest on two millions of loans, expect to make on the remaining $3,000,000, as the capital, say 13⅓ per cent. - - -		400,000
The public,		
On the other hand, will be benefitted after the following manner:—The consumption of anthracite coal is now ascertained to be about 900,000 tons per annum, the average price hitherto may be stated at $7 per ton, which, on the opening of this railway will be reduced to $5, being a *direct saving* of $2 per ton, or in all say - - - -	1,800,000	
To which may be added, an equal *indirect saving* by the reduction of the price of wood and other fuels, and generally in the cost of the innumerable wants of		
Amount carried forward	$1,800,000	$4,00,000

Amount brought forward,	$1,800,000	$4,00,000
the community, now produced by steam power, together with the infinity of new applications of that power in consequence of the reduced price of fuel; all of which may be stated to be equal to a similar saving of - -	1,800,000	
		3,600,000
Total gain to the community by this railway on the single item of coal at the present amount of consumption -		$4,000,000

This is no fancy picture, but which may be fearlessly presented to the intelligent as not overcharged. Such are the benificent effects of the railway, arising in the perfect control at all times, which is had over its immense powers; while it is otherwise with water improvements, which in all northern latitudes are fettered in ice at one time, at others are dried up, and anon are overwhelmed by a torrent.

[For the American Railroad Journal and Mechanics' Magazine.]

EXPORTATION OF SPECIE.

"We are noticing from time to time the exportations of specie from the United States to foreign countries. During the last six weeks, as stated in yesterday's paper, the aggregate amount shipped from New York to Europe exceeded two millions of dollars.

"A wholesome trade implies the exchange of commodities. The productions of industry in one country are bartered for the productions of industry in another. We cannot afford to pay specie in large quantities and constantly for foreign productions, because specie has other services to perform beside those of trade. If a surplus of specie accumulates, more than is wanted for the uses of currency, it then becomes a mere commodity, like tobacco or tea; being disengaged from those other relations which in ordinary circumstances it hold to the circulating medium. But in this country we have no surplus; there is a scarcity: our currency is prostrated for want of a specie basis. Policy—common sense—inevitable necessity—demands a change in our regulations of trade, We cannot continue to admit the productions of foreign countries that will not take our staple productions in return. England and France refuse almost every American commodity except cotton. They would refuse that if they could, and they hope in time to be able to do so.

"We have been laboring for a National bank; and beyond all question the interests of the country require such an institution. But unless a stop is put to the foreign drain of specie, we do not see how a National bank is to re-establish our downfallen currency. A National bank will be subject, like other institutions, to the unfavorable influences which have paralyzed our circulation; it can do no more than any other bank to keep specie in the country when the force of circumstances drives it out; it can substitute no other means to supply the foreign demand; it can bring into existence no new production to be available in paying our European debt. With a substantial tariff, a National bank may do all that is expected of it;—without a tariff, its ability for good to the country must necessarily, we think, be much restricted."—*Baltimore American.*

The above remarks on the exportation of specie express sound views and in terms easily comprehended—it is a subject which yet puzzles many wise heads, and the oftener it can be presented in a clear light the better.

Two thirds of our commerce is with England and France, and much the largest portion with the former, where the tendency is always from the redundancy of population and capital, to over production, the natural consequence of which, is, to force upon her customers more than they are generally able to pay for in commodities agreeable to her, and specie is then required to make up the balance. Either she must take more of our agricultural products, or by a tariff we must be enabled to buy less from her, by producing the difference at home.

Free trade, as understood by these two nations, is truly hit off in the following words, mark too, that *after ourselves*, they are allowed to be the most enlightened in the world: "*England and France refuse almost every American commodity except cotton, they would refuse that, if they could, and they hope in time to be able to do so.*"

No one disputes the beauty of free trade as an abstraction, and which can never prevail until RFCIPROCITY comes into fashion—but from which man, whether in his individual relations, or as congregated into nations, is now as distant in practice as he ever was; or is he not perhaps a little farther off? Any hope then of free trade alias reciprocity, becoming general is utterly forlorn, and for the present the attempt to introduce it would be to contend against "policy—common sense—and inevitable necessity."

Without this tariff, a National bank as here remarked, would do but little good—but that vexed question may now, however, be considered as put at rest—as it now seems very generally conceded that

the element all essential to its profitable working, *full confidence in those who must conduct it*, cannot be reposed—certainly the history of banking of late years fully justifies this mistrust, and few will again be found entrusting the management of their earnings *to any but those* who may be *equally* with themselves interested in their safe employment.

Disappointed thus in a bank, through so lamentable a cause, as the infirmity of human nature, we are not without a resource or a substitute in the railway, its quick transit and facility of communication making it a most effectual leveller of exchanges, and what other evils it might not cure, could be borne with in comparison with the troubled sea, which a National bank seems ever destined to keep up, while the banks of the States, always jealous of encroachment, cannot be controlled. A subscription therefore, of seven or ten millions of dollars by Government towards aiding and stimulating private enterprize to make *main post lines* of railway, would do far more general good than if subscribed to any bank, and would be quite as constitutional an application of the people's money, in the single effect of facilitating commerce between the States, beyond all other means, and as a *circulating medium* answers fully to the term.

Our country is still destined to be the direction in which a large portion of the annual accumulation of foreign capital will seek investment, and the more so, were our vast home resources better shielded by a fixed judicious tariff. Does any thing more than the uncertainty of our legislation in this respect tend to keep capitalists aloof? Fortunately however, since the opening of a constant avenue to Philadelphia from the coal and iron beds in Pennsylvania, it will be soon discovered that they can be made to give up their treasures without much extraneous aid, and the ability once demonstrated of being able to place constantly in market, at a profit, say, pig iron at 20 to $22, and anthracite coal at 4 to $4½ per ton, foreign competition would quickly cease, and Philadelphia would rise up to be the eastern, as Pittsburg is now justly called the western, Birmingham of America.

The value of imported iron is rather over seven millions of dollars per annum, which could nearly all be supplied at home, if we would attract capital around our mountains by offering it the security of a permanent tariff. It would be the part of true wisdom that we sought for thorough and entire independence in this great staple at least, which is constantly being applied to new and important uses. When the avenues to market at Philadelphia are perfected, what a field will be opened for good investments at Sunbury, situated at the junction of the north and west bran-

ches of the Susquehanna, a region teeming with mineral treasures. The cost of materials at that point for making a ton of iron are thus given:

2½ tons of iron ore, including mining, mine rent, and transportation at $1,50 per annum	$3,25
1 ton of limestone at - - - - - -	65
3½ tons of coal at $1,75 including steam power,	6,62½
	$10,52½

These estimates are not merely theoretical or speculative, but are taken from actual results in daily operation, and there can be little doubt that this would be one of the points from which pig iron could be furnished in the Philadelphia market, at 20 to $22 per ton and to yield a fair profit.

That our readers may have before them the particular articles of import, with the valuation attached, which it would be as well if possible, to produce ourselves, we copy the following list from the New York Tribune, a paper zealously devoted to the encouragement of home labor and reciprocal commerce. We hope to see the "home league" made a rallying point throughout the Union, and which our richer and heavier capitaled rivals abroad, will understand as not approving the system, but as only retaliating, and as the most effective means of forcing them into free trade *in reality*, that is accompanied by reciprocity, which we always have been and will continue to be ready for on those terms. This is precisely one of the *exceptions* to the general rule, that *two wrongs* cannot make *a right*.

Statement of the principal articles of foreign manufacture imported into the United States, for the year ending Sept. 30, 1840.

Articles.	Amount of imports.
Woolen manufactures - - - - - -	$6,345,345
Cotton do. - - - - - - -	6,504,484
Silk do. - - - - - - - -	10,982,191
Lace - - - - - - - - -	468,425
Carpeting - - - - - - - -	338,501
Hats and bonnets - - - - - - -	438,000
Boots and shoes - - - - - - -	71,533
Leather - - - - - - - -	473,091
Cabinet ware - - - - - - - -	86,275
Soap - - - - - - - - -	13,859
Manufactures of iron and steel - - - - -	7,324,482
" Flax and hemp - - - -	5,966,944
" Copper, brass, tin, pewter and lead	362,423
Amount carried forward	$39,555,453

Amount brought forward	$39'555,453
Earthen and stone wares	2,010,231
Plated, gilt and japanned do.	166,072
Saddlery	201,000
Worsted stuff goods	2,387,338
Watches and parts	420,959
Glass manufactures	563,429
Cotton bagging	310,211
Oil cloths	33,648
Paper hangings	76,521
Paper	76,124
Books	210,764
Hair cloth	59,555
Brushes	38,762
Jewelry	201,590
Saltpetre	24,171
Cigars	869,434
White and red lead	41,043
Sugar of lead	11,385
Cordage and twine	244,911
Corks	56,186
Total	$47,378,888
Exports of the above articles	3,809,526
Consumption in the United States	$43,569,362

Most of the manufactures in the above list of imports, it will be observed, come in direct competition with articles made by our own manufacturers and mechanics. More than two thirds of the above imports might doubtless be advantageously manufactured in this country if we had adequate protecting duties. About two thirds of all our imports into the United States consist of luxuries, and manufactured articles which should be made here. Thus many millions are thrown away annually, keeping us always in debt to foreign countries.

[From the Journal of the Franklin Institute.]

Continued from page 277.

ON CAST IRON RAILS FOR RAILWAYS. *By* ELLWOOD MORRIS, *Civil Engineer.*

IV. On the subject of the comparative durability of wrought and cast iron rails, the experiments are not entirely decisive, but they certainly appear to incline in favor of those of malleable iron;* al-

* See Wood on Railroads, third edition, page 133 and 729.

though it must be remarked that the exfoliation and separation into laminæ, which, owing to the mode of manufacture, it was originally anticipated, would occur to wrought iron rails, when travelled by locomotives at high speed, and the existence of which was formerly most pointedly denied, *does actually take place*, as may be witnessed upon most of our railroads which have been long subjected to the action of heavy trains and high velocities; upon such we may perceive not only exfoliations on the rails, but also that in some instances the sides of the heads have been forced into laminæ, and almost, or actually crushed off; it cannot be doubted that all such disruptions of the material facilitate oxidation and wear, and, therefore, if due weight is given to this cause of deterioration, which was not formerly taken into the account of decay of wrought iron railways, there seems to be reason for the belief, that under the action of a weighty traffic, cast iron rails may reasonably be expected to endure quite as long, if not longer, than those of malleable iron, especially if the former have their heads, or top tables, properly *chill cast*, which ought certainly to be done; it must also be recollected that if from wear, breakage, or any other cause, it becomes necessary to substitute new rails, the old cast iron ones would be worth at the foundries, almost the price of pig metal.

General Remarks.

The introduction of the hot blast, by enabling the ores of iron to be smelted direct with raw bituminous coal, and the recent application of anthracite to the same purpose, rendered successful by the same means, has, in consequence of the diminished cost of cast iron in the coal basins, drawn the attention of enterprizing practical men in this country, to the propriety of employing cast iron rails, instead of those made either of wood plated with wrought iron, or wholly of the latter material.

At the Lonaconing works in Alleghany county, Maryland, cast iron train rails, with an upright ledge, of the usual form, are wholly used for the service of the coal and iron mines.

The writer is indebted to J. H. Alexander, Esq., Civil Engineer, and Topographical Engineer of the State of Maryland, for the following information respecting the rails cast and used at those works.

1. The Lonaconing rails are of the common tram pattern, of three and a half inches base, and two and three quarter inches height; they are a little heavier at the joints than in the middle; the length of each rail is three and three quarters feet, the weight, forty-five pounds, or thirty-six pounds per yard lineal; for the curves, which are usually of ten feet radius within the mines, separate patterns are used in casting the rails.

2. Some of the rails were cast direct from the ore, and had the furnace continued in blast all would have been.

3. The hot blast was used in casting the greater part of the rails from the cupola, and altogether with those from the blast furnace.

4. There was no difficulty attending either moulding or casting the rails.

5. Intermediate between the ends which rested on a cross tie

there was placed out of doors a block of wood, but within the mines, slate was packed under the rails instead.

6. One hundred and ten tons of rails of the above pattern were laid.

7. These rails are valued at the furnace at $40 per ton by the quantity.

8. The cars run upon these rails carried one ton, or one-quarter of a ton on each wheel, besides the weight of the car.

Mr. Alexander further observes, that from their experience at Lonaconing, he has "no doubt of the useful application of cast iron to larger works, and accordingly the plan of the railroad designed to connect the Lonaconing mines with the Potomac river, rests, in part, upon the adoption of that material."

Since iron has been made in Schuylkill county, in this State, by using anthracite as the fuel for reducing the ore, cast iron rails have been substituted in several coal railways instead of the plate rail upon wood; and wherever they have been used they appear to have fulfilled every expectation formed of their utility, and have been universally approved.

The writer is indebted to Samuel B. Fisher, Esq., of Pottsville, Surveyor, for the following information respecting the cast iron rails employed in that portion of the anthracite region of Pennsylvania.

1. The lengths of rails most used are six feet; but some of twelve and fifteen feet are about to be cast, and any required length short of twenty feet can be made.

2. Some of the rails have been run at the blast furnaces direct from the ore, while others were cast by the cupola.

3. The rails are generally laid on cross ties, three feet apart, from centre to centre.

4. Some rails have been cast by Eckert & Guilford, at Pinegrove, with charcoal fuel, of the weight of eighty-four pounds per lineal yard from a pattern furnished by B. Aycrigg, Esq., Civil Engineer, the section being that of the U, or bridge rail, *cast solid;* the rails now cast at Pottsville are similar to the T pattern.

5. If care is taken in moulding and removing the castings no warping occurs.

6. The rails used under ground for mines, weigh from twenty-seven to thirty-two pounds per yard, while others, for outside use, weigh, from fifty-three to sixty pounds per yard running.

7. Cast iron rails are found quite smooth enough for use.

8. The cast iron rails cost from $40 to $45 per ton at the blast furnace, and $56 per ton when cast at the cupola from re-melted iron.

9. On the heavier rails, cars, weighing, with their loads, from four to four and a half tons, are drawn by horses at the rate of about four miles an hour.

10. Few, if any, instances have occurred of a rail breaking from regular use.

Mr. Fisher further states, that the rails cast at the foundries are preferred before those run at the blast furnaces.

On this branch of the subject, notwithstanding its importance in an economical point of view, there are no decisive experiments known to the writer, but this much we can declare, that it is by no means a settled point that castings made from re-melted iron are better than those which are run at the blast furnaces direct from the ore; at least, the idea of such superiority seems *to rest wholly upon opinion, and not upon experiment;* in the recent discussion which took place in New York, regarding the conduit pipes and other castings necessary for the supply of water to that city, it was stoutly maintained by the friends of the cupolas that castings from re-melted iron were the toughest and best, and this was as stoutly controverted by the advocates of castings run at the blast furnaces direct from the ore.

In the midst of the dispute, Frederick Graff, Esq., superintendent of the Water Works of Philadeldhia, was appealed to, whose long experience in this matter entitles his opinion to the utmost respect, and he stated that the conduit pipes, and all the other castings, now, and for many years, used in the distribution of water through the city of Philadelphia, under a head as high as 100 feet, were made at the blast furnaces direct from the ore; Mr. Graff further declared, that after having, in 1821, repeatedly proved and examined pipes cast in both ways, he had not been able, "with his experience, from that time to this, to determine why a pipe cast from the ore was not as good as one cast from re-melted iron, nor had he been able to determine why other castings cannot be made as perfect and durable from the ore as in any other manner."

On the other hand, the experiments detailed in Wood on railways, third edition, page 127, show clearly enough, that a mixture of different kinds of cast iron forms a stronger, though also a heavier rail, than any one kind of iron cast separately; and this mixture can evidently be had only by re-melting iron through the agency of a cupola furnace.

But let this be as it may, there is no doubt that rails of sufficient strength can be most economically cast direct from the ore, and they would be cheaper than those produced at the foundries, even if it should be found necessary slightly to enlarge their dimensions.

The writer has been informed by Erskine Hazard, Esq., one of the managers, and Josiah White, Esq., the president, that the Lehigh coal and navigation company having adopted a heavy T rail of malleable iron, for their railroad from Whitehaven, upon the Lehigh, to Wilkesbarre, upon the Susquehanna, a distance of twenty miles; contracted for it in England, at £10 10*s.* per ton; but one ship-load having been lost at sea, they resolved to supply its place with rails cast from anthracite iron, at the furnace now in operation upon Crane's principle, on the Lehigh canal, about fifty-five miles below Whitehaven, the eastern terminus of the railroad; and with these they purpose laying about four miles of the road next to Wilkesbarre, on which horses are to be used.

The malleable iron T rail of the road referred to, weighs forty-eight pounds per lineal yard, and is near five inches deep, three quarters of an inch thick in the stem, and two inches wide on the

head; the cast iron rail designed to supply its place upon four miles of the road, is of a similar section, but made six inches deep, a little larger every way, and weighs seventy-five pounds to the yard; it is cast in six feet lengths, direct from the ore, by anthracite worked with the hot blast.

The strength of this rail was tested at the furnace, with six feet bearing, and it required *more than* five tons weight to fracture it; consequently, at three feet bearing, its strength (with the same section being inversely as the distance between the supports,) is ten tons, but we have already shown, in a former part of this paper, that, according to Professor Barlow's experiments, and the relative properties of cast and malleable iron, an available strength of nine tons in a cast iron rail is ample to sustain the progress of trains carrying three tons on a wheel, and running at thirty miles an hour; consequently, if the rail of the Lehigh and Susquehanna road is laid with three feet bearings, as is now contemplated, it will be equal to all the present exigencies of trade, and might be safely travelled by twelve ton locomotives at a very high speed; this rail covering *but two bearing spaces* between the joints, ought to have its supports spaced equally, which is, in fact, designed.

The writer has recently observed upon the Columbia railroad, a short distance laid with cast iron rails, apparently for trial; these are in section nearly parallelograms, about two inches thick by five inches deep; they are wedged in cross ties, about three feet apart, and appear to answer perfectly.

In a former part of this paper, we showed that a cast iron rail, of strength sufficient to resist, without permanent injury, a strain of nine tons, was equivalent in stiffness to a wrought iron rail of seven tons strength, and this ratio we took as the guide of comparison between rails of these materials; hence assuming that the weights of rails suitable for the same railway should be as these numbers, then if a wrought iron rail of seventy pounds per lineal yard is competent to carry any given trade, a cast iron one, proportioned for the same traffic, should weigh ninety pounds per yard, for 7 : 9 : : 70 : 90.

The cost of the *imported wrought iron rails* of the Lehigh and Susquehanna railroad, when delivered on the road, will be about $65 per ton, while those of *cast iron*, for the same road, will scarcely exceed $45; therefore, if the latter was strictly proportioned in strength to the former, the ratio of economy at the above rates would be,

70 tons at $65 - - - - - -	= $4,550
90 tons at $45 - - - - - -	= $4,050
Difference, -	= $500

which, with these particular prices, would make the cast iron rails cheaper than those of English rolled iron, in the ratio of nine to eight; and if compared with American wrought iron rails, the relative economy would be still more conspicuous; the price of foreign railway iron delivered in America, fluctuates very much, but it is

believed that it would very seldom be so low as to make the rolled rails cheaper than those of cast iron of equal strength, even if the former should continue to be admitted into our ports free of duty. We do not wish to be understood as asserting, in this paper, that cast iron rails are intrinsically superior to those of malleable iron; all that has been proposed is to show that the former material is equally sufficient and suitable for the formation of railways, while it is generally *more economical;* but there is one practical advantage which is inherent to cast iron, and ought not to be overlooked, it is, *that it expands and contracts less than wrought iron by alterations of temperature.* Tredgold's essay on cast iron, informs us that while malleable iron expands $\frac{1}{143000}$ of its length by each degree of heat, cast iron elongates but $\frac{1}{182000}$ by an elevation of temperature to the same extent, consequently their ratio of comparative dilatation is nearly as seven to eight.

That cast iron is thus refractory under heat, is of some practical importance, for if the rails be cast in lengths of ten feet, the lineal elongation produced by an alteration of 100° in the temperature, would be only $\frac{1}{1820}$, or about $\frac{1}{14}$ of an inch, so that if rails of from six to ten feet lengths are used, and the laying is carried on at medium temperatures of the weather, they may then be placed almost, or quite in contact end to end, the unavoidable imperfections of the joints allowing sufficient play; and as the joints will therefore be so much closer than can be admitted with malleable iron rails, less objection will be made, even if their number should be greater.

James Herron, Esq., Civil Engineer, in a memoir descriptive of his patent Trellis railway, of continuous bearing,* which he has recently laid before the public, makes at page 35, the following judicious remarks, touching the subject we have under discussion, and which we take the liberty of quoting:—

"That cast iron rails can be furnished from our own mines at a much cheaper rate in the United States, than foreign rolled iron rails, seems probable from the improved modes of smelting iron with anthracite coal. That they will fully answer the purpose, when constructed and laid as I have described, there are but few engineers of practical experience in mechanics, and who are familiar with the extensive use made of cast iron edge rails throughout England and Wales, on their mineral railways, will deny. Should there be some, however, who are disposed to advance adverse views, it matters not from what motives, let me ask them why is it that the chilled cast iron wheels of our railroad cars should have so completely superseded the imported wrought-tried wheels, if it be not their *greater durability and cheapness* that recommended them?

"Within the last two years, some millions of dollars have been sent out of the country for the purchase of railway iron, which has been, for the most part, admitted duty free, and if we may

* A very ingenious railway of continuous bearing, has been devised by B. H. Latrobe, Esq., Civil Engineer, (see the March No. of this Journal, 1841,) consisting of a Z rail attached laterally to a continuous string piece; this peculiar arrangement is strikingly deserving of trial upon a working scale, and *on a bed of concrete.*

form an opinion from the rapid deterioration by crushing, exfoliation, and splitting of the heavy rolled iron rails but recently laid *on some of our roads*, many millions more must continue to follow them, to furnish a supply for the renewals and repairs, so that it will form an insatiable drain on the currency of the country.

"A material that enters so largely into, and forms so costly a part of, our great public works, should not, therefore, be imported from a foreign country, if we can by any possible device render our native materials available. That the large sums of money which would thus be retained in the country would greatly benefit the mining, manufacturing, and farming interests, and, in fact, all others, even the works themselves, by an increase of business, must be evident to all."

Reflecting, then, upon the following facts, that for a long series of years cast iron rails were successfully used in England for public railways, that they are now used a great deal in the mineral districts, that they were originally superseded, in consequence, chiefly, of the superior enconomy of malleable iron rails, that so far as they have been used in this country they have fully answered every expectation, that the peculiar character of the strains upon a railway is such as cast iron is well calculated to withstand, that they can be well and cheaply made in this country, instead of sending our money abroad for foreign iron, that the transportation of iron rails from the sea-board to many of the interior railways, is very expensive, and finally, that they are as cheap, or cheaper, than wrought iron rails of equal strength*—can there be any reason why cast iron rails should not be universally adopted in the United States? On the contrary, are we not urged to their exclusive use by every consideration of economy, as well as of patriotism in supporting home, instead of foreign manufactures? And do not the arguments in favor of *cast iron rails*, appeal with peculiar force to all those States, which, like Pennsylvania, possess within their bosoms inexhaustible supplies, both of the ores of iron and the means of fusing them into metel?

PHILADELPHIA, *September* 1, 1841.

LOUISVILLE, CINCINNATI AND CHARLESTON RAILROAD COMPANY.

At an anniversary meeting of the stockholders of this company, held yesterday, at the hall of the South Western railroad bank, the following report was submitted, and ordered to be published, for the information of the stockholders:

The special committee to whom was referred a resolution of the company, adopted at the meeting in February last, "That in the opinion of the meeting, it is expedient and necessary to promote

---

* The Congress of the United States, at their late session, have passed a law providing that from and after the 3d of March, 1843, all foreign railroad iron imported into this country, shall be subject to "a duty of twenty per cent. ad valorem," and that no iron shall, hereafter, be allowed to enter free, except what may be required for railroads, or inclined planes, *now under construction*. This act would seem to settle the question of economy decidedly in favor of the use of cast iron rails, on all future railroads constructed by the American people.

economy in the expenditures of this company; and for the efficient management of its business, the affairs of the two companies, the L. C. & C. R. R. company, and the S. C. & C. R. R. company, be consolidated under one board of directors, and one set of officers, and that a committee be appointed to report the manner of carrying the same into effect at the next meeting of the stockholders"—

Report.

That in considering the mode in which the concert in the direction and management of the two companies may be effected, as contemplated by the resolution, they find that by the original charter of the C. & C. R. R. Co. twenty-four directors were provided, three as the local representatives of each of the States of Ohio, Kentucky, Tennessee, North Carolina, and South Carolina, and nine, as the general representatives of the whole stock. In consequence of Ohio not acceding to the terms of the charter, by an amendment granted by act of assembly in 1836, the number was reduced to twenty-one; and by the same act it was provided that unless Kentucky accepted the amendment granted by that act, the company should exist in the State of Tennessee, North Carolina and South Carolina, with twelve general and three local directors for each of the last mentioned States. By a further amendment, granted by act of assembly in 1840, it was provided that the stockholders in the States of Tennessee and North Carolina might release their shares to the company and receive back the amount of their subscriptions. By this amendment it was contemplated that the charter of the company should be limited to the State of South Carolina. The interest of the Kentucky stockholders was withdrawn from the company at a very early period of its existence. The stockholders in Tennessee and North Carolina, there seems to be little doubt, will all release their shares to the company under the permission granted by the act of 1840. It is, therefore, very doubtful whether there be any local interest in the last mentioned States to be represented, or any stockholder who may be qualified, by the possession of fifty shares, to serve as a director. If no local directors be elected for these States, the number will be reduced to fifteen. By the omission to elect local directors for those States the relinquishment of the charter in them may be inferred. It is believed to be the impression of the stockholders of this company, that the charter has been by the act of 1840, confined to this State, at least the committee believe it is the opinion of the stockholders, that it is the policy and interest of the company, that the charter should be so limited. Under these circumstances it is recommended by the committee, that fifteen directors, the number required under the charter and its amendments, be elected from the stockholders in South Carolina, from which number a president is to be elected, constituting a president and fourteen directors for the government of the company. By the charter of the S. C. & C. R. R. Co., the direction consists of a president and twelve directors—except that the election of the president of the S. C. & C. R. R. Co, is by the stockholders, from among themselves, and of the C. & C. R. R. Co. by the directors from their own number; the provision of the

two charters in all particulars affecting the purpose of the present inquiry are, in most respects, precisely similar. The term of service of the directors is in both companies for one year and until an election. Their general powers, with respect to contracts, meetings of the board and company, manner of authenticating contracts, supplying vacancies in the board between the periods of election, are the same, and the seal of votes by the stockholders is the same.

In the year 1839, this company purchased all the stock of the S. C. & C. R. R. Co., with the exception of a few shares, so as to posses the entire control of the affairs of that company. By the charter of neither company is it prohibted for the president, directors and officers to serve in the same capacity in any other company. The same individuals therefore may be elected to those stations in both companies.

The manner in which this shall be done, may admit of difference of opinion. The committee, however, recommend that the president of the company be authorized and instructed by a resolution, in all elections of president and directors of the S. C. & C. R. R. Co. to represent the shares held by this company, and to vote for the twelve individuals as directors of that company, who at the election for this company, had received the largest number of votes for the office of directors, and to vote for the same individual to be president of that company who might hold that office in this company. The immediate agency of this company, cannot be extended beyond the election of president and directors. But the expression of the will of this company, respecting the election of subordinate officers and other particulars, designed to effect a concert in the management of the affairs of the two companies, it may be assumed, will be respected by the president and directors of that company, and recognized by them as obligatory. In order to complete the arrangement proposed, it will be necessary to declare that the offices of treasurer and bookkeeper, subsisting in this company and the offices of treasurer and secretary in the S. C. & C. R. R. Co. be abolished at the expiration of the terms of office of the present incumbents. If this company approves the recommendation of the committee, to postpone carrying into effect the system proposed until the completion of the road to Columbia, these officers may be retained with the understanding that their employment is indefinite. Otherwise, immediately on the expiration of the period of their offices, those proposed by the committee in substitution of them may be elected. For a permanent establishment the committee have concluded that after the completion of the branch of the road to Columbia, one president with a salary of three thousand dollars, one auditor, with a salary of two thousand dollars, and one secretary, with a salary of twelve hundred dollars, will be sufficient for the bureau service of both companies. The compensation of the two latter offices may be thought excessive, but from the nature and responsibility of the duties required of the auditor, the committee deemed it important to make such an allowance as would invite competition and secure the continued services of any one who might be found qualified for the office. The salary of the assistant clerk

has been fixed at a higher rate than otherwise it would have been, from the consideration that he must occasionally discharge the duties of the auditor, and should be a person of like experience, character, and permanent employment. In addition to this motive, the secretary is charged with the duty of receiving and forwarding merchandize on the road. This arrangement recently made, has not yet given to that office any larger share of business, but it is expected as soon as it becomes generally known, to devolve on him an active and responsible charge, and that the increase of the business of the road by the employment of an officer to receive and forward goods without charge, will greatly outweigh the consideration of his salary.

After a careful inquiry, the committee have been induced to recommend that the union of the direction and officers of the two roads be deferred until the meeting of the company in November, 1842—not that they would affirm such union at the present time, to be impracticable, but that they believe a judicious economy would retain the present organization, until the branch to Columbia is completed. The existence of two presidents is a superfluity, rather in name and appearance than in reality. Their duties are very different, and in both departments very important. One is engaged in superintending the affairs of a road in active operation, and the other in constructing a branch of the road through a very difficult country. It is believed that neither could be without serious prejudice to the interest of the company, greatly exceeding in amount the salary, divide his time between the duties of both. The officers in the service of the S. C. R. R. Co. the committee are assured, could not undertake also the duties discharged by the officers of this company. Besides, that the former are fully engaged in the proper dutuies of their offices; the business of the latter requires for its proper discharge the experience of the present officers. Until the accounts with contractors on the branch be closed, the scrip issues be discontinued, the stock list of the railroad company and bank be completed, and the regular call for instalments be discontinued, it is thought most advisable to retain the officers of this company also. The committee derive support for this recommendation from the belief that at the time of the adoption of the resolution referred to them, it was supposed the branch to Columbia would by this time have been nearly if not quite completed. It seems that that event has from unavoidable difficulties been retarded, and may not be expected before July next.

The result of the report in what relates to retrenchment of expenses, may be stated thus:

By immediate reduction in the salaries of the president,	$1,000
In the salary of superintendant of transportation by discontinuing the office, - - - -	2,000
In the rent of offices, - - - -	500
Amount carried forward	$3,500

Amount brought forward,	$3,500
By reduction after the union of the two companies, in the salary of the president, - - -	2,000
By discontinuance of offices and reduction of salaries,	3,300
	$8,800
To which may be added reduction in bank salaries,	5,800
	$14,600
And the salaries of the principal and assistant Engineers, - - - - -	6,000
	$20,600

Making an agregate retrenchment of expenditures of $20,600, to be effected in the course of a year.

In the engineering department for the construction of the road to Columbia, there appeared to the committee, no room for further reduction. In the expenditures for the various employments connected with the transportation of freight and passengers, and keeping the road and engines in repair, the committee have not been able to make any reduction. The amount seems large but the employments are so much out of the experience and knowledge of the committee, that they cannot undertake to say it is too large. But the committee are convinced from the zeal and determined spirit of economy actuating the presidents of both roads, that every retrenchment, compatible with the interest of the companies, will be effected as time and circumstances may permit.

For the convenient consideration of the measures recommended in the report, they propose the following resolutions:

1. *Resolved*, That fifteen directors be elected to serve for the ensuing year.

2. *Resolved*, That at all meetings of the S. C. & C. R. R. Co., the president of this company do represent the stock held by this company in that corporation, and that in elections for president and directors of that company, he be instructed to vote for the individual who may be president of this company to be president of that; and for the directors of that company to vote for the twelve individuals who have received the greatest number of votes as directors of this company.

3. *Resolved*, That the president of this company do vote to postpone the election of president and directors of that company until the meeting of this company in November, 1842.

4. *Resolved*, That the offices of superintendant of transportation, and of treasurer and bookkeeper of this company be abolished after the expiration of the terms of office of the incumbents; and thereafter that the services of the last two mentioned officers, if necessary, be retained indefinitely.

5. *Resolved*, That the president and directors of the S. C. & C. R. R. Co. be requested to abolish in like manner, the offices of sec-

retary and treasurer in that company, and that the services of those officers, if necessary, be retained indefinitely.

6. *Resolved*, That until the meeting of this company in November, 1842, the salary of the president be $2,500 per annum; and that the directors of the S. C. & R. R. Co. be requested to fix the salary of the president of that company at the same sum.

7. *Resolved*, That the stated and special meetings of the two companies should be held on the same day and in the same place.

8. *Resolved*, That from and after the meeting of this company in November, 1842, the business of both companies be transacted by one set of officers; and that it consist of one president for both companies, with a salary of three thousand dollars; an auditor and a secretary, the first with a salary of two thousand dollars, and the latter with a salary of twelve hundred dollars, who, in addition to their duties as officers of this company, shall discharge all such duties as may be required from them by the S. C. & C. R. R. Co.

9. *Resolved*, That the offices of the two companies be removed as soon as practicable to the building occupied by the S. W. R. R. bank.

10. *Resolved*, That after the completion of the road to Columbia, one superintendant of the road and two assistants only be employed, the salary of the principal to be $2,000, and of the assistants not more than $1,200 each.

ANDREW WALLACE, *Chairman.*

THE NEW BRIDGE AT FAIRMOUNT.

We visited Fairmount a few days since, and took some pains to inform ourselves of the peculiarities of the new bridge, now in course of construction across the Schuylkill.

The position which this structure occupies in the neighborhood of the most favored haunts of our city, renders its erection a matter of more than ordinary interest, and it is with satisfaction we find that it has been progressing very vigorously, though quietly, since its commencement.

This bridge is to be supported by 10 cables of iron wire, which are to be stretched across the river from one abutment to the other, and well secured on the eastern shore in the solid rock, and on the western side, in massive walls which rest on the rock. Each of these cables is formed of nearly 300 strands of iron wire about the eighth of an inch in diameter, which are assembled and bound together by ligatures of smaller wire, so as to form ropes or cables from 2 to 3 inches in diameter.

The separate strands of wire are covered with a varnish which is intended to protect them from oxydation, and the use of which is said to be justified by experience. These cables are to be upheld by four columns of granite placed near the edges of the abutments; two of which are now nearly completed, and exhibit we think, a specimen of substantial and excellent workmanship. They are formed of very large blocks of granite, which are obtained chiefly from the quarries at Hallowell, in Maine. These blocks are dressed with

much care, and so placed in the columns as to form pillars of great strength, and quite ornamental. The columns are 30 feet in height, and 8½ feet square at the base. They stand on abutments of massive masonry, which have been built up from the surface of the river within the last three or four months. The wire cables are to pass over the tops of these columns and then descend towards the middle of the bridge to the level of the flooring—forming in their course symmetrical curves which we presume will present a very graceful appearance.

The flooring or carriage way, is suspended from the cables by 170 wire cords, similar in their construction to the cables themselves, but of much smaller dimensions. The suspenders are attached to the cables by a very simple cast iron saddle, and are secured to the joists of the flooring by wrought iron bolts. The cables are 647 feet long; and the span of the arch from centre to centre of the supporting columns, is 357 feet. The width of the bridge is 26 feet in the clear space between the parapets—10 feet of which space is appropriated to the carriage way, and four feet on each side is reserved for the footways.

The fastenings by which the ends of the cables are secured are somewhat curious. Those on the western side of the river are now completed. This work consisted in excavation of the soil down to the rock; which here constitutes the bed of the Schuylkill, and founding upon it very large and heavy walls of masonry into which were anchored 120 large bars of iron. These bars are completely imbedded in the masonry and terminate in archways which are intended to receive the cables and protect them from contact with the earth where they penetrate the soil. Indeed every necessary precaution appears to have been observed to secure the cables against the corrosive influences of the atmosphere and the earth.

On the whole, from our idea of the character of this work we should judge it is destined to be an exceedingly graceful and imposing structure, and peculiarly adapted to the picturesque scenery in which it is situated.

The work is progressing with great rapidity and will be finished by March next, if not delayed by the difficulty of obtaining the heavy granite blocks necessary for the remaining columns.

We regretted to learn that two of the vessels laden with the blocks intended to be used in the bridge were lost in a recent gale, and that the deficiency has yet to be supplied from Maine.

The bridge is constructed at the expense of the county, and under the superintendence of Mr. Ellet, the Engineer, who furnished the plan. We wish him success in his enterprize; though we should judge from the magnitude of the edifice, and the costliness of the materials employed, that the contract price (fifty thousand dollars) will hardly remunerate him for his exertions. The former bridge on the same site cost about one hundred and twenty thousand dollars, though the masonry was of the coarsest description, and the superstructure of wood. We can, therefore, hardly suppose that such an edifice as is now in progress, composed of massive blocks of granite, finely cut and beautifully fashioned, and which is supported by

cables of an indestructible material, can be erected on the same ground for less than one half the cost of its predecessor. At any rate if Mr. Ellet succeeds in accomplishing the work at his estimate, we speak for this sort of bridge, a degree of popularity which may eventually remunerate him for the hardness of his present bargain. —*U. S. Gaz.*

[From the Civil Engineer and Architect's Journal.]

ON THE THEORY OF BARS.

"Lorsque l'homme s'ecarte de la vraie cause d'un objet quelconque, il doit se considerer dans les tenebres, et il est force de chercher des arguments absurdes, dans lesquels il se perd, ce qui fait que les sciences deviennent ridicules dans l'opinion du vulgaire."—*Cuvier on marine deposits.*

Sir—Pursuant to the notice I gave in the last number of your valuable Journal, I take leave to send you for insertion the following observations on a "New Theory of Bars, etc., by Mr. Brooks."

The importance of the subject to this great naval and nautical nation, and to the maritime commerce of the world, should admonish us to pursue the investigation of this matter with the most cautious and serious consideration, for as it is well observed in the quotation at the head of Mr. Brooks' treatise, "our errors in this matter are of more importance than in mere objects of taste, luxury, or pleasure, because they will ever result in injury, or in the loss of some previous advantage," Let us also bear in mind Cuvier's reproof quoted above.

It does not appear requisite that I should refer to the many theories quoted by Mr. B., the controversy so prevalent at present, and in past times, in the scientific world on the subject of bars, demonstrates that it has not received that attention and examination which can lead to a right conclusion as to their cause, and what are the most eligible means to obviate the many evils incident to their existence; but I do presume that my subsequent remarks, based on facts and practical observations, will prove, that if the desideratum has not previously been developed, Mr. B. has not reflected any new light on a subject hitherto by many supposed to be enveloped in darkness.

It appears apposite to notice that Major Rennel, quoted by Mr. B., p. 1 and 2, states, "that mud and sand suspended in the waters," (*i. e.* the egress waters) "during their motion are deposited when that motion ceases, or rather they are gradually deposited as the current slackens, according to the gravity of the substance suspended;" and the late Mr. Telford gave a similar exposition. I did not expect in this age of the world, any one would reject such an evident and irrefutable fact, a principle ever in operation during the discharge of the egress tides, or currents; but Mr. B. p. 4, says, "I venture to submit, that it is insufficient," (*i. e.* the Major's thesis) "to account for the formation of bars, because the operation described (the deposit,) as producing the latter (the bar,) takes place

in all rivers, in a greater or lesser degree, and in those which although their waters are abundantly loaded with sand or mud, are nevertheless free from bar." Mr. B. therefore disputes the accuracy of the Major's deduction, because it is the result of a partial, and not of a general law; why, Mr. B. has endeavored to rest his entire case on local and partial data, and neglected to observe general principles.

That all rivers, harbors, bays, estuaries, etc., where the waters pass with a velocity sufficient to hold matter in suspension, have *beds* of sand, etc., is quite correct; but where the receding waters do not return or run out into the ocean with a force adequate to disturb the deposit that occured during the quiescent state of the waters, as described by Major Rennel, there certainly *no bar or exterior accumulation* can take place; for matter does not move without an impetus. Mr. B. then *de facto*, leaves the Major's thesis (with which I agree,) where he found it, based on the solid and immovable foundation of truth.

It is quite obvious that the Major has adopted the thesis that I have, viz.

1st. That wherever rivers. sluicing, or back waters disembogue into the ocean, either under a natural or artificial impetus, and run with sufficient velocity to hold matter in suspension, and cause a conflicting action with the waters into which they pass, there a bar is formed.

2nd. That wherever there is an absence of egress waters, currents, tides or sluicing power, and where no conflicting action ensues, there no bar exists.

3rd. That to these rules there are no exceptions throughout the world, for wherever nature is placed under similar circumstances, she is immutable in her results.

> "Here then we fix the universal cause,
> God acts by general, not by partial laws."

These primordial, universal, and indisputable facts are deduced from an extensive field of observation of many years, and on various harbors, rivers, etc., during which time I have visited the Baltic, Gulf of Finland and Bothnia, Russia, Prussia, Denmark, Sweden, Norway, Jutland, Friesland, Holland, Belgium, France, Spain, Portugal, the Mediterranean, Africa's shores, and many harbors of the united kingdom,—but all this devotion has been dealt with by Mr. Brooks in a most summary way, and to refute my theory he has used the following words, page 5, chap, 6, viz.:—"That the casual direction of the lower reach, or the position of the mouth of the river cannot truly be assigned as the cause of the existence of a bar, is easily proved by observation on rivers subject to great variations at the enterance, the bar being always found to exist independent of the direction of the discharge into the sea, this fact at once refutes the third and fourth theories."—In this extract there seems to be two distinct facts, *i. e.* the casual direction of the lower reach, and the independence of a bar, in the direction of the discharged waters, that is, he means that the deposit or bar does not occur in

the direction or course of the egress waters. With respect to Mr. B.'s assertion of the independence of the bar, of the egress waters, I have much to say, if he be correct, he has indeed "at once refuted my theory," and would prove it to be a mere visionary and hypothetical deduction; but I will proceed to show the converse, and that he has committed, as in other parts of his book, an egregious error. If the reader will turn to the author's theory, subsequently here inserted, where he uses the *wedge* to aid his illustration, and where the battle with the elements occurs at the first quarter flood, he will find it stated, "that in the conflict, the sand or other materials, which it was (*i. e.* the effluent waters,) capable of holding in suspension previously to its encountering the conflicting action of the flood tide, yields it to the latter, and when this takes place the *bar is formed*;" now observe, Mr B. tells us that the material which drops and forms the bar, is brought down into the ocean by the egress or effluent waters, that as it advances onwards, (in its own direction of course,) it encounter the flood tide, and where it meets that tide, there the bar is formed; so that Mr B. himself destroys the premises which he had the boldness to adopt for the annihilation of my thesis. The positive and irresistible fact, is, that all bars are formed in the direction of the effluent waters, the latter are the impetus to the matter held in suspension, and that matter must fall in the direction of the impelling power, as a shot from a gun, the ball from the foot, or the deposit from the stream of the milldam.

Passing on towards Mr. B's. theory, I notice in chap. 2, page 19, "pier harbors, which though free from bar in their natural state, are well known to become encumbered by them, on the introduction of the scouring power," here I suspect he cast his eye southward on Lowestoft piers. Scouring power no doubt (this is my principle,) causes a bar, no matter whatever way or manner it is conducted to the sea, naturally or artificially, whether there be piers or no piers.

The commencement of chapter 11 is a mere repetition of my second proposition, "that whenever a river or harbor approximates to the condition of a simple inlet for the reception of the tide, it would have no bar." I endeavored some time ago, in conversation with Mr. B., to illustrate this truism by a reference to various harbors where the water did not pass into the sea, with a sufficient velocity to disturb the bed, there no exterior deposit could take place; no matter whether such a harbor be naturally or artificially constructed. Norway, Scotland, Ireland, Scilly Islands, Minorca, and Malta harbors, are of the first kind; Ramsgate, Margate, Scarboro', Cronstadt, Elsinore, etc, the latter.

In page 13, Mr. B. in noticing the geological features of the Yorkshire coast, says, "that a residence of some years on its shores, and a close observation enables him to state, that those seas that break on the outward platform, (the outer flat) are much heavier than those which break nearer the shore." I bear testimony to the accuracy of this fact, taught me in my boyish days by the boatmen, sailors and fishermen, that on all flat shores, or in different elevated platforms (if they must be so designated,) the sea loses its force, where it is first intercepted by the shore, and as it advances and rolls

up the inclined plane, so the concave dimension diminishes, till at last it finishes in a mere ripple, or tiny billow.

I have now arrived at our author's theory, and it is *multum in parvo.* "During the period of the first quarter flood, the current, in lieu of being able to take its natural upward course, as in rivers where *no bar exists*, is opposed, or effectually checked, by the effluent backwaters; the declination of the stream in the lowest division of the river presenting a head which ensures a strong downward current, long after the tide would have been able to maintain an upward course, provided the backwater had a free discharge; at this period the flood tide, by reason of its greater specific gravity, occupies the lower stratum of the tide way, and like a wedge endeavors to force its course up the channel, which it is unable to effect, but merely elevates the lighter effluent water, the lower strata of which, being checked by the opposition of the tidal waters, yields to the latter, the sand or other materials which it was capable of holding in suspension, previously to its encountering the conflicting action of the flood tide; where this takes place the bar is formed."

Having shown that Mr. B. has attempted to refute my thesis by the aid of a fallacious assertion, I now proceed to prove that he has based his own on a sandy foundation. He commences this part of his work by stating that the current, in the first quarter flood, is not able to take its natural course upwards, as in rivers, where no bar exists—that is, where a bar does exist it is not able—and that this inability is occasioned by the conflicting action of the waters (and which conflicting action only exists where a bar is already formed,) and where this takes place (the conflicting action,) there the bar is formed. So that, in order to sustain his "novel theory" on the cause of bars, he first must have a bar, to produce the cause of a bar, and thus the effect produces the cause, and with this mode of reasoning illogical as it is, he has attempted "at once," and with one fell swoop *nolens volens*, to throw me overboard and in his general sweep, all who have attempted by principle and practice, ancient and modern, a development of the cause of bars. Mr. Brooks requires a backwater falling out of a sloping river, and that water to be opposed by a first quarter flood, and a bar, itself to produce a bar; he appears not to be aware that in various parts of the world bars have accumulated where there is an entire absence of his causes, and not only at places "which approximate to the condition of a simple inlet," but where the only existing cause, amongst those which he assigns for a bar, is the egress or scouring waters; examples of which we have in the Baltic, the Black, and other seas.

In my examination before a committee of the House of Commons in 1826-1827, on the proposed Lowestoft harbor, I then stated "that so soon as the scouring water should be applied as then proposed, a bar would accumulate where no deposit or bar previously existed, and if the sluicing were continued, the harbor would be so blocked up that small vessels only could enter at high tide." He need only refer, to prove the accuracy of his prescience, to the present state of the bar at that harbor, and the fact that about £150,000 have been expended thereon, the entire of which has been recently offered for

sale by the loan commissioners for £17,000, it being completely lost as a harbor of refuge for which it was intended.

It is an incontrovertible fact, that the greater quantity of egress, or sluicing waters, and the more rapid their course, the greater is the exterior deposit. The Mississippi and other large rivers demonstrate this fact—the entrance to that queen of rivers is most difficult in the spring of the year, when the melting of the snow on the mountains increases the quantity and rapidity of the egress waters, so as to carry with them, trees, earth, and other matter, all of which are deposited on the extensive bar, at its outlet, and it does not again decrease until after a long continuous dry season, when the quantity of egress water is reduced.

Mr. B. follows his "new theory" by stating, "that he might easily extend his illustrations," and adds that the "direct tendency of the whole period of the ebb, when unobstructed by the tidal currents, must be to reduce the bar." This is really hypothetical.—That the ebb or outgoing waters have a direct tendency, and are the real cause of all exterior deposits or bars, etc., I have asserted for the last 20 years, the accuracy of which I will now attempt to prove. At the Neva, gulf of Finland, the Narva, Dantzic, the Danube, the Nile, and many other places, the current, without intermission (there being no *flood tide*,) is perpetually running out at the rate of six, seven or eight knots per hour, and yet the old entrances to those rivers have been blocked up by impassable bars, and either new passages have been cut into the ocean, or the egress waters have forced a passage out in a new direction; here we have an absence of quarter flood, sloping, and of the difference in the gravity of the two waters, no salt water being in the vicinity of the disemboguing site of the above rivers.

I must now take leave to make an observation on Mr. B's. proposition to take away the shoals or deposits in the Thames, at Woolwich by scouring, and not by dredging, the result of such an operation (if it were accomplished) would be, that the matter moved could only be impelled onward, while the impetus was retained, but so soon as that ceased, a re-deposit would occur, which would occupy the same extent of the bed of the river, which it had previously done—he seems not to be informed of the effect produced on Barking Shelf, removed by dredging, although an immense accumulation of sand and shingle, the base of which appeared at low water, but I will not further interfere with the interior part of his subject, that is all plain sailing, no insurmountable difficulty occurs in attempts to improve inland navigation, there we have no impinging billow, or any material effect produced by the winds or tides.

Before I conclude, allow me to give some farther proofs of the accuracy of my two first propositions—New Zealand, "the entrance to the bay at Wangarver is 11 miles broad, perfectly safe, and without a bar; the bay is studed with rocks, (so are the harbors I have previously referred to as being free from bar.) The water is deep close to the shore. The bays of Plenby and Port Nicholson are similarly formed and are free of bar, although no back waters. The harbor of Hokianga with an extensive interior river, where the wa-

ters run out at every ebb tide, there a bar exists. In the West Indies, at St. Lucia and the Havana, both splendid harbors, but have neither rivers, backwaters, nor bars.

I remain, sir, your obedient servant,

HENRY BARRETT.

FLINT AND OCMULGEE RAILROAD.

We copy from the "Southwestern Georgian," published at Albany, Baker county, the following remarks on this railroad:

"General Brisbane, with commendable energy, and a perseverance which would daunt most persons, is pressing forward this all important work; about two-thirds of the whole distance, (we learn from a gentleman from that quarter) is already graded. It is an unfortunate circumstance that the planters in that section of country are not aware of the vast improvement which will result to their property, from the completion of this road. They have generally commenced planting there with small means, and have been so far removed from railroads, that they have had no chance of testing their advantages.

"This road pierces the very garden of Georgia, whose rich products will come to our own doors. We wish it might receive some aid from Savannah, as we consider it next in importance to the Savannah and Macon railroad. Charleston promised to help them out, if the planters would stipulate that the crop should be laid down in that city. Such an arrangement would be too expensive, and those concerned are for other reasons strongly opposed to such a plan.

"From an advertisement in our paper, it will be seen that at a recent meeting held by the directors of the company, at this place, it was ascertained, 'that an accession of the small sum of $30,000 to its present means, payable one half on the first day of January, next, and the other half on the first day of January, 1843, will enable the company to complete the work, within the ensuing year for the transportation of freight and passengers.' Savannah, if she knows her true interest, will come forward and subscribe for these three hundred shares. It will open to her the richest part of the State, the trade of which, in less than five years, will be of more value than any other. However much the people of this section may wish to give a city of their own State the preference, if they are compelled to obtain assistance to carry on this work from the city of another State, to that city the trade will eventually be carried. Savannah certainly will not permit this; she knows her interest too well to suffer a work which will bring the best trade of the State to her door, to be defeated for the want of the pitiful sum of $30,000."

We give our most cordial assent to the views of this writer, as to the bearing of that road on the interests of Savannah. Any one has but to take the map of Georgia, and look at the counties through which it runs, to see what a large territory it will bring into prox-

imity with us; and a very little inquiry on the subject will convince the most incredulous that you have but to give those counties easy access to a market, to develope their agricultural resources, and thus increase their wealth, population and influence. We are not for urging reckless investments, but we think that the merchants of Savannah have a deep interest in this scheme, and that by showing the counties in the southwest our willingness to assist in this enterprise, and our appreciation of its value, it would create a strong reacting feeling in our behalf, and might exercise no inconsiderable influence in bringing it to ultimate success. The true interests of Georgia are bound up in the carrying out of these improvements; for nothing can more surely call forth the resources of the State; nothing can more effectually create and sustain trade; nothing can more happily draw out the energies of the people; nothing can more certainly add to their wealth; nothing can more speedily break down all the sectional prejudices of the various counties, and unite us all as one people, striving for one common good, than the advancement and completion of the works of internal improvement, begun and projected in Georgia. This is not theory, but strict, experimental truth, which the history of every railroad country and corporation will confirm, and which cannot be too often or too forcibly presented to our readers, particularly to those (if any there can be) who are dubious of the benefits and advantages of railroads. —*Savannah Georgian.*

INTERNAL IMPROVEMENT IN GEORGIA.

In the extent and magnitude of her schemes for internal improvement, Georgia stands first, south of Pennsylvania.

There are now commenced no less then five railroads, viz.: the Central railroad from Savannah to Macon, the Georgia railroad, the Monroe railroad, the Western and Atlantic railroad, the Flint and Ocmulgee railroad.

These traverse the most productive agricultural districts of the State, and communicate with the Atlantic by two channels, viz.: Charleston via Hamburg railroad, and Savannah. We have long since urged upon our citizens the importance of making one of our own ports the outlet of the State, and having spoken of the attempts strenuously made by the Carolinians, to control the railway trade and operations of the up-country. Intent upon their own interest, striving to make Charleston the emporium of the Atlantic South, her merchants knowing the resources which the upper part of our State presents, are striving to turn to their own markets, the trade which should flow only to our own. This is a serious subject; and this, we think, a critical period. It is no time to slumber in indifference when our neighbors are stretching every sinew, or to relax our efforts when they are ever augmenting theirs. Our own railroad is steadily progressing towards its terminus. The report of the Western and Atlantic road, shows that operations are kept up there, and that section after section, is gradually put under contract, graded and made available. One half of the Flint and Ocmulgee

road is already graded, and the rest under, contract; and the other roads are completed, or progressing to their several destinations.

With these facilities growing up around us, with the resources of the State daily augmenting, with every element of State wealth and greatness, the important question comes up, how shall the system be controlled?—how shall all these resources be made available to the interest of the State and its citizens, and make Georgia what she should be, the key-stone of the south? To sell the State road, would be suicidal; to withhold further appropriation, would depreciate its stock and destroy its usefulness. No, there is, we think, but one way, and that is FORWARD. Carry out by every laudable means the great schemes already begun; throw the country open to the influence of railroads, and though the State may be temporarily embarrassed, yet she would soon receive more than compensating returns, and in the increased value of her lands, her produce, her stock, her mines, would be repaid a hundred fold both in wealth and honor. Unless some vigorous system is adopted, all these resources will but turn to the benefit of another State, and our rich and productive interior, instead of finding its natural outlet in the ports of Savannah, Darien, and St. Marys, will be drawn away to swell the profits of other merchants, and the revenues of another State. New York is already beginning to feel the effects of her supineness, in silently allowing the Bostonians to tap the great railroad line of the west at Hudson, and thus divert to its city, the produce which had else found its way to the former. They are indeed endeavoring to remedy the evil by the Erie and New York railroad, but it will be no easy thing, even admitting that it can be done, to dispossess Massachusetts of her strong hold upon the western trade. Happy would it be for our State, if her leading men would unite on these measures of internal improvement; if, for a time, they could free themselves from the curse of party prejudice, and legislate with enlightened and liberal minds for the good of the State; forgetting all sectional interest, all local divisions, all dissonance of political feeling, in the one aim of raising our State to the position which her size, her resources and her wealth entitle her. While we are wrangling, others are working; and while our energies are wasted in angry debate, others are expending theirs in efforts which are impairing our strength, to nourish their own. The splitting up of these simple measures, on which union is all essential to prosperity, into party measures, may be our ruin.

Let enlightened legislation rescue our State from so disastrous a result.—*Savannah Georgian.*

THE STEAM FRIGATE CLYDE,—TRIAL TRIP.

In our last we briefly noticed the trial trip of the steam frigate Clyde, and promised to give a more particular account of this splendid vessel in the present number. She is the first of the fleet of fourteen vessels, recently contracted for by the British Government, for the double purpose of carrying, during peace, the mails to our West India colonies, and in time of war to act in the capacity of

armed vessels of the largest size and power. The first trial of the Clyde was looked forward to with an intense and extended interest, every one feeling that the prospects of the Royal mail steam packet company, who have made the contract with Government, were dependent in a great measure upon its success; and because it was expected to demonstrate whether the construction of these ships had been able to combine, with the great capacity and strength required in war frigates, the requisite speed, power, and accommodation absolutely indispensable to the performance of their duties as packets conveying the mail, and carrying passengers on a longer voyage than any yet accomplished by our trans-atlantic steamships. We, therefore, feel much pleasure in being able to assure our readers that the trial was, in every sense of the word, highly satisfactory.

Before alluding farther to this matter, we may mention that the Clyde is by far the largest and most powerful steamer in her Majesty's service. Her engines are nominally of 480 horses' power, but they are capable of working up to a much higher effect. The nominal tonnage of the ship by the old law is 1350 tons, but her real capacity is about 1800 tons. She is constructed with the strength and proportions required for carrying Paixhan's guns of the largest class about ten inches in diameter, which are now coming into use for firing shells and hollow shot to the greatest distance. The whole frame and beams of the Clyde are of the best British oak, bound and fastened in every direction, so as to combine all the means that are known for giving the greatest strength to so large a structure.

She has one complete system of diagonal oak trussing between her timbers—a complete internal ceiling caulked and fastened like the outer skin—and a third system of oak and iron trussing upon the ceiling itself. The result of all this strength is such, that the shape of the vessel, now that she is afloat with all her machinery, and a considerable quantity of coals, stores, and fresh water, has not altered one inch since she rested on the blocks in the building yard of its able artificer the late Mr. Robert Duncan.

The Clyde and her sister ships, the Tweed, the Tay, and the Teviot, are all of the same dimensions—all built on the river Clyde—have all engines of precisely the same size and power—are constructed on the plans and under the direction of Mr. Scott Russel, of Messrs. Caird, & Co. of this town, who are the contractors for furnishing the four frigates complete and ready for sea; and it is worthy of remark, as showing the capabilities of our establishments of the kind, and how little we have to fear in the event of sudden war, that although not more than fifteen months have elapsed since the order was given, three out of these four vessels have already received all their machinery, and will within a few weeks be ready for sea. Thus one single establishment in thist own has completed engines of the agregate power of 1920 horses, in the short space above referred to. At this rate it is plain that the river Clyde alone, could, in a year, furnish a fleet of twelve such frigates, and one per month for any longer period.—*Greenock (Scottish) Advertiser.*

ELECTRO MAGNETIQUE LOCOMOTIVE.—The following annunciation of a vast improvement by a new modification of mechanical power must, we should think, attract very generally the public attention:

"A letter has been received from Leipzig, dated 23d July, stating that Mr. Lewis Gabriel Stochrer, a mechanician of that city, has just finished an Electro Magnetique locomotive, the greatest part of which is constructed after Mr. Wagner's plan, and which has been purchased by the Germanic Diet. This locomotive is of seven horse power, and will draw three cars full of passengers. It costs about $1,000, instead of $7,500, the cost of a common steam locomotive; the supply for it amounts to not more than 60 cents per day.

"The experiments which have been made with Mr. Stochrer's locomotive on the railroad between Leipzig and Dresden left nothing to be desired."—*Translated for the National Intelligencer from the Echo du Monde, savant No. 653, Paris, 4th Aug.* 1841.

POWERS OF LOCOMOTIVE STEAM.—A steam coach running at a moderate rate, which is about 21 miles per hour, would run over a distance of 500 miles per day of 24 hours, and at that speed would reach British India from London in about 8½ days—or Pekin in China in 11 days—or from Gibralter to the Cape of Good Hope in 10 days—or from Quebec to Cape Horn in 17 days—or once round the globe in 51 days—or 7 times round the globe in one year—or a distance equal from the earth to the moon in about 16 months, or from the earth to the sun in 500 years.—*Greenock paper.*

RAILWAY TRAFFIC.—One week's receipts from the principal lines of railway in Great Britain, according to our last week's returns amounted to £97,670 on a captial of £37,000,000. Deducting one half for expenses, which is full as much as they average, there remains a balance for dividend of about 7 per cent, proving at once that railway speculations have not been so unproductive as some would represent; for although there has been a loss (or rather no profit) on some lines, it is more than made up from others. The country at large, therefore, has been rather a gainer in regard to investment of capital, to say nothing of the immense benefits conferred on the whole community in making and keeping those undertakings in repair, as well as in the cheaper, speedier, and safer mode of travelling to which they have given birth.—*Railway Times.*

LOCOMOTIVES FOR COMMON ROADS.—A gentleman residing at Southwell, Dr. Calvert, has constructed a machine, which he purposes to call "the *Alternate*," because he rides or walks in turn according to the ascending or descending inclination of the road he travels. By merely rising from his seat, and throwing part of the weight of the body upon the hands placed upon a guiding bar, he *walks* with less fatigue than he could do without the machine, especially where the ascent is not very steep. On descending he sits down and *rides* at his ease with considerable speed. The propelling action (the most powerful that can be exerted, and one of the most lasting,) is that of rowing.—*Nottingham Journal.*